

Appl. No.: 10/707,403
Amdt. Dated: 2/20/2006
Reply to Office action of: 12/08/2005

AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions, and listings, of claims in the application:

LISTING OF CLAIMS:

Claims 1 – 2 (canceled)

Claim 3 (currently amended) Method ~~according to claim 2, characterized in that~~
~~said additional time variant filtering of said signal (11) is carried out by means of~~ for
canceling echoes and noises in environments with variable acoustic conditions and high
feedback, inside of a vehicle, for the purpose of permitting the establishment of a clear,
audible communication between the occupants of the different areas of said vehicle,
which can be implemented in a communication system integrating:

at least a first microphone (1) located in a first site, susceptible to receiving an
existing original speech signal (5) and generating an electric signal from said original
speech signal using an assembly comprising several A/D – D/A converters, amplifiers
and filters;

at least one speaker (3) prepared to receive said electric signal (13) and to
transform it into an acoustic signal (7), susceptible to being received by said first
microphone (1), together with a new original speech signal (5) and noise (9), both
existing near said first site; and

an operative acoustic echo canceller system (15) using said electric signal (13),
which will be reproduced, and an electric signal (10) supplied by the microphone and
A/D converter means, this signal (10) comprising the feedback of said reproduced
acoustic signal (7), a new existing, original speech signal (5) and a noise (9) seized by the
microphone, whose echo canceller system (15) is applied to remove said feedback,

characterized in that it carries out an additional filtering of an electric output
signal (11) of said acoustic echo canceller system (15), resulting from the treatment of

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said signal (10) sent by the microphone (1), comprising a two-stage Wiener filter (16), coupled in cascade, a first of them (22) applied to the elimination of a possible residual echo not suppressed by the echo canceller system (15) and a second stage (23) intended to suppress the noise components (9) of the interior present in said signal (11), the calculation of the frequency response of both stages (22, 23) being carried out by a spectral power density estimate of said residual echo and by a spectral power density estimate of said noise present in said signal (11).

Claim 4 (original) Method according to claim 3, characterized in that said power density estimate of the residual echo and the spectral power density estimate of said noise (9) existing in said signal (11) comprise the following stages:

storing M number of samples of said input signal (11) in a buffer memory (50), together with an M number (L-1) of samples of the same in a previous instant, ordered from the oldest to the most recent, the number M being set by the maximum permitted delay for auditory integration, in the passenger's ear, between the sound received directly from the calling party and the reinforcement provided by the communication system;

weighting said LM samples in a window (51);

applying a fast Fourier transform in a stage (52), and

smoothing the spectrum of said input signal (11) by means of a smoothing following a MEL type frequency weighting of the real and imaginary parts in respective phases (53a), (53b) so as to reduce the estimate variance from whose real and imaginary parts said spectral power density of the input signal (11) to the Wiener filter (16) is estimated.

Claim 5 (original) Method according to claim 4, characterized in that in the case of weighting the samples of the residual echo signal, the averaging time window (51) is short, whereas a long averaging time window is used for weighting the samples of the noise signal, which are more stationary than the speech signal.

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Claim 6 (original) Method according to claim 3, characterized in that by carrying out an initial attenuation phase (18) of the input signals (5, 7, 9) to each microphone (1) that are compensated with a proportional amplification stage (21) of the electric signal (13) sent to the corresponding speaker (3) for its reproduction after the suitable filtering and cancellation of echo tails and noises in said Wiener filter (16).

Claims 7 – 13 (canceled)

Claim 14 (currently amended) ~~System according to claim 12, characterized in that said assembly applied to a filtering varying in time comprises~~ for canceling echoes and environmental noises with variable acoustic conditions and high feedback, in the interior of a vehicle, permitting the establishment of a clear, audible communication between the occupants of different areas of said vehicle, which comprises:

at least a first microphone (1) in a first site, susceptible to receiving an existing original speech signal (5), and to convert it into an electric signal (13) using an assembly comprising several A/D – D/A converters, amplifiers and filters; and

at least one speaker (3) for receiving said electric signal (13) and to convert it into an acoustic signal constituting a reproducible, audible communication (7), which is fed back to said first microphone (1), together with a new original speech signal (5) and noise (9) existing in the area, said first microphone (1) and conversion means providing an electric signal (10); and

an operative acoustic echo canceller system (15) using said electric signal (13) which will be reproduced and an electric signal (10) supplied by said first microphone comprising the feedback of said reproduced audible communication (7), a new existing, original existing speech signal (5) and other acoustic noise signals (9) existing in the area, whose system (15) is applied to eliminate the feedback of said audible communication (7) seized by said first microphone,

characterized in that it integrates an assembly applied to an further additional

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filtering of the electric signal (11) after leaving said acoustic echo canceller system (15) comprising a two-step Wiener filter (16), a first (22) of them applied to the elimination of a possible residual echo that is not suppressed by the echo canceller system (15) and a second one (23) for carrying out the elimination of the noise in the area, whose two-step filter (16) is calculated by means of an estimate of the spectral power density of said residual echo and an estimate of the spectral power density of said noise, both existing in said signal (11).

Claims 15 – 22 (canceled)